Chancellor, R.D., B.-U. Meyburg & J.J. Ferrero eds. 1998
Holarctic Birds of Prey
ADENEX-WWGBP

Effects of the Feeding Station Establishment on the Egyptian Vulture *Neophron percnopterus* in Dadia Forest, North Eastern Greece

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INTRODUCTION

Among vultures occurring in Greece, the Egyptian is the least endangered species, still breeding in a variety of habitats. Information on population status, breeding success and food habits is very limited (Handrinos 1985). It seems that the species follows the population decline occurring in other Mediterranean areas (Frumkin 1986; Bergier & Cheylan 1980; Bergier 1985; Grubac 1989).

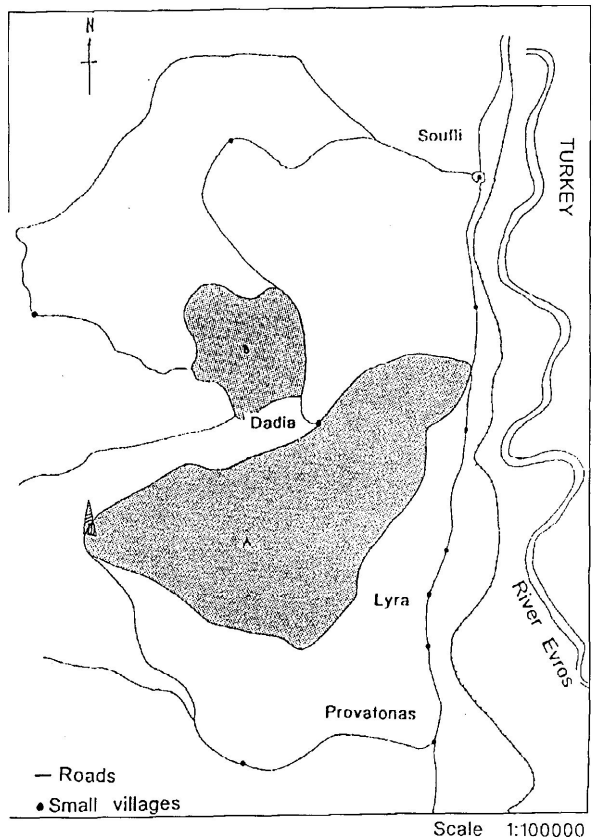
During recent years a general population decline of the species has been observed in the whole country and especially in Dadia forest, which is considered to be the most important breeding area in Greece.

Even though the Greek Forest Service established in 1987 a feeding station in Dadia forest, in order to provide supplementary food for vulture species, no signs of population increase was observed in the Egyptian Vulture.

The investigation was carried out from 1984 to 1994 in Dadia forest, province of Evros, Greece with the following objectives:

1. to study the population trends of the species
2. to determine its food habits
3. to determine its breeding success and
4. to determine its nest-site characteristics

Figure 1. Study area.



STUDY AREA

Dadia forest is located between 40° 59'-41° 15'N and 26° 19'-26° 36'E. The reserve includes a core area of about 7,000 ha and a buffer zone of about 40,000 ha. It rises from 50m above sea level, reaching up to 800m.

Apart from the Egyptian Vulture, other species such as the Cinereous *Aegypius monachus,* Griffon *Gyps fulvus* and Bearded Vulture *Gypaetus barbatus* occur here too. The Bearded Vulture was observed as a winter visitor.

The climate is Mediterranean with dry summers and rainy winters. During the breeding season (April to September) the mean monthly temperature was 17.1°C with minima and maxima of 5.5°C (April) and 29.3°C (August) respectively. The mean monthly precipitation during the above period was 38mm, with minima and maxima of 0mm (August 1986) and 106mm (June 1986) respectively.

The area supports a *Pinus-Quercus* association. The main plant species are: *Pinus brutia, P. nigra, Quercus conferta, Q. pubescens* and *Q. cerris.*

Other species occurring with lower frequency are: *Erica arborea, Phillyrea media, Arbutus andrachne, Juniperus oxycedrus.*

Apart from the raptors, the fauna includes a large number of bird species (100), mammals (20) and reptiles (21).

METHODS

Information on the number and distribution of nesting pairs was acquired 1984-1994. The research was carried out from March to September every year.

Active nests were located at the beginning of the nesting season and were visited to collect pellets, food remains and to estimate breeding success.

The diet was determined by analysis of pellets and prey remains found in the nests. The identification of mammals was made using a hair key (Papageorgiou & Sfougaris 1989). Feathers and skulls used for bird identification and reptiles were identified from a scale key (Papageorgiou *et al.* 1993).

Identification and classification of tortoises found on the nests was done according to classification proposed by Zug (1991) and Stubbs *et al.* (1984). Age determination was based on the classification of these authors.

Eighteen transects (100x5m each) were taken to estimate the abundance of tortoises in five different biotopes in the spring of 1990 and 1992. For purposes of comparison the data of Helmer and Scolte (1985) and Vlachos (1989) were used to compare the density of the tortoises in different habitats.

For each Egyptian Vulture nest the following variables were measured: 1) height of cliffs, 2) height of nest above ground, 3) diameter of nest cup at rim, 4) depth of nest cup, 5) orientation of nests and 6) exposure of cliffs.

Distances to nearest stream, feeding station, road and village were measured using a topographical map (1:5,000).

The nesting habitat was determined by vegetation analysis within a radius 500m around each nest.

RESULTS

Breeding success

The Egyptian Vulture arrives in the study area at the beginning of April. The chicks hatch in the second half of June and fledge at the end of August. During the 10 year study, the number of breeding pairs declined from 14 to 5 (Table 1). Before and after establishment of the feeding station in 1987 the average number of eggs per nest and the number of young were 1.80, 1.40, 1.70 and 1.30 respectively. The average percentage of hatchability, survival and breeding success was 92.5%, 85% and 79% prior to establishment of the feeding station an 83%, 91% and 75.5% respectively after the feeding programme (Table 2).

Table 1: Breeding success of Egyptian Vulture in Dadia forest (1984-1994).

Year	Number of breeding pairs	Number of nests with one egg	Number of nests with two eggs	Hatchability %	Number of nests with one young	Number of nests with two young	Fledglings per nest one	Fledglings per nest two	Survival of young %	Number of eggs /nest	Number of young /nest	Breeding success
1984	14	3	11	88.0	6	8	8	5	82	1.8	1.3	72
1985	13	4	9	100.0	4	9	4	8	91	1.7	1.5	91
1986	10	1	9	89.5	3	7	4	5	82	1.9	1.4	74
1987*	9	1	8	76.5	3	5	3	4	85	1.9	1.2	65
1988	8	2	6	78.5	3	4	3	3	82	1.8	1.1	64
1989	8	3	5	92.0	2	5	2	5	100	1.6	1.5	92
1990	8	2	6	64.0	3	3	3	3	100	1.7	1	64
1991	7	2	4	100.0	2	4	2	3	80	1.4	1.1	80
1992	6	2	4	70.0	1	3	1	3	100	1.7	1.1	70
1993	5	-	5	80.0	-	4	-	4	100	2	1.6	80
1994	5	1	4	100.0	1	4	2	3	80	1.8	1.6	89

* establishment of feeding station

Table 2. Breeding success of Egyptian Vulture in relation to feeding station establishmnet in Dadia forest (1984-1994).

Year	*Mean Number of* eggs/nest	young/nest	*Average percentage of* Hatchability	Survival	Breeding success
		%	%	%	
1984-1987*	1.80	1.40	92.5	85	79.0
1988-1994	1.70	1.30	83.0	91	75.5

1987*: Feeding station establishment

Nest-site characteristics

The Egyptian Vulture nests on small cliffs scattered along the deep valleys. As is shown in Figure 2, the species was found to use three types of nest. 53% of the nests were found in circular caves with mean height 0.8±0.2m, mean width of entrance 1.3±0.5m and mean depth 1.3±0.4m; 18% in triangular caves with mean height 0.8±0.1m, mean width of entrance 1.2±0.04m and mean depth 1.2±0.2m; while 29% of the nests were on open ledges with mean depth 1.1±0.29m.

Figure 2. Types of nests of Egyptian vulture

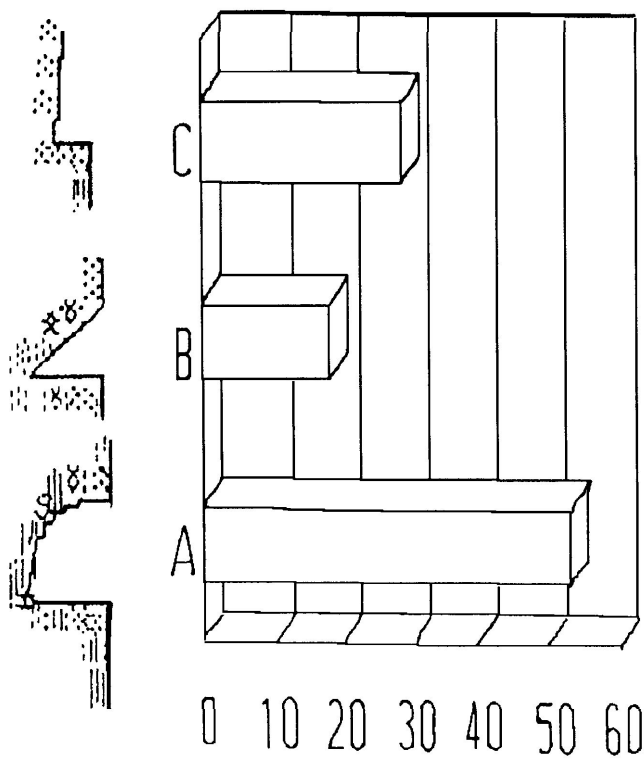


Figure 3. Distribution of nests in relation to feeding station

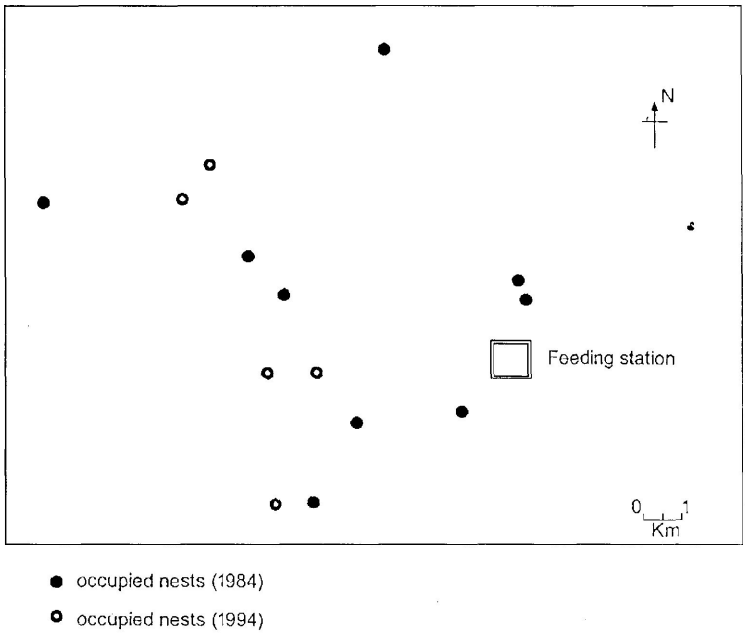


Figure 2 shows the distribution of the nesting cliffs, ranging in elevation from 80m to 358m. The mean height of the cliffs was 14.7±5.7m and the mean height of the nests above ground level was 9.3±4.3m. All nests were placed approximately at 0.6 of the cliff's height, while 82% of the cliffs were found at the bottom of the valleys.

Figure 4. Exposure and orientation of nesting sites

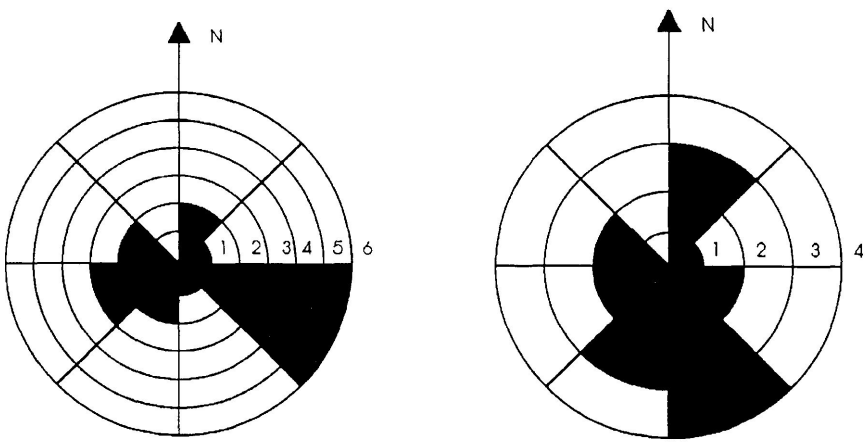


Table 3. Nesting-site characteristics of Egyptian Vulture in Dadia forest.

N=14

Variables	Mean ± SD	Range
Elevation (m)	209.3 ± 81.0	80 - 358
Height of cliff (m)	14.7 ± 5.0	8 - 30
Height of nest (m)	9.3 ± 4.0	5 - 22
Nest diameter (cm)	34.8 ± 3.0	20 - 80
Nest depth (cm)	4.4 ± 1.0	3 - 6
Distance to nearest stream (m)	82.0 ± 6.0	15 - 230
Distance to feeding station (km)	6.3 ± 3.0	1.5 - 14.4
Distance to garbage-dump (km)	5.5 ± 2.5	0.3 - 11.0
Distance to asphalt road (m)*	695.0 ± 354.0	205 - 1050
Distance to C' class wood road (m)**	161.0 ± 63.0	80 - 225
Distance to B' class wood road (m)	294.0 ± 188.0	5 - 570
Distance to nearest village (km)	4.5 ± 1.9	0.9 - 8.6

* only four nests

** only five nests

The mean distance of the nests from the feeding station was 6.2±3 km and the mean distance between the nests 1.7±1.0 km (Fig. 3); 76% of the nesting cliffs faced NE to W, while 70% of the nests had an orientation from 45° to 270° (Fig. 4, Table 3).

Vegetation analysis around each nesting cliff within a radius of 500m showed that the habitat consisted of mixed forest (60%), shrubs (18%), cultivated land (0.5%), rocks (19%) and other forms (3.5%).

Food habits

A total of 394 pellets and prey remains were collected during the study period. The results of the analysis are presented in Figure 5. The most important groups of prey before establishment of the feeding station (1987) were livestock (29.7%), followed by tortoises (26.1%), small mammals (10.8%), birds (10.7%), lizards (9.6%), snakes (6.5%), terrapins (3.4%) and toads (2.8%). After establishment of the feeding station the percentage of livestock increased to 62.3%, followed by tortoises (15.9%), wild mammals (9.1%), lizards (3.8%) and snakes (3.2%).

In all 78 tortoises were found and identified in prey remains, 29.5% being *Testudo hermanii* and 70.5% *Testudo graeca.* All the tortoises were classified in seven length classes (Fig. 6). It was found that 78.2% were less than three years old. Since tortoises were found to form the principal live

Figure 5. The percentage of occurrence of the most important food groups in the diet of the Egyptian Vulture (1985-1992).

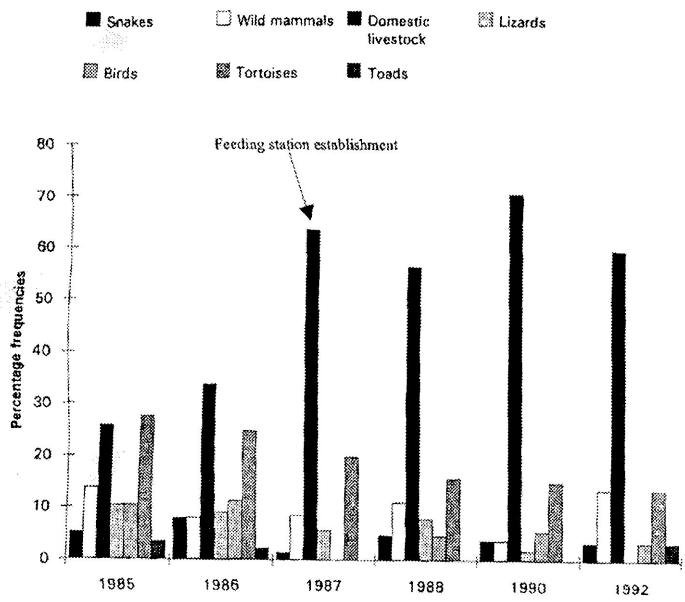
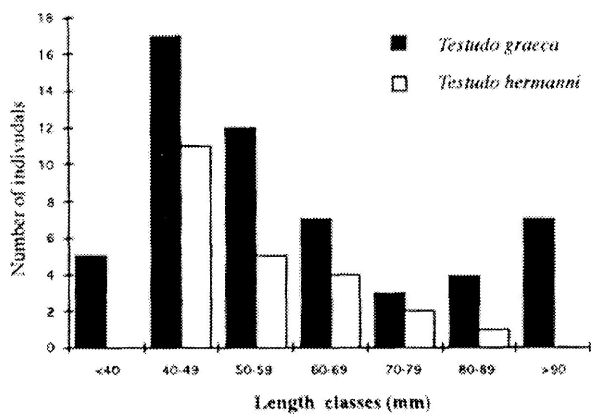
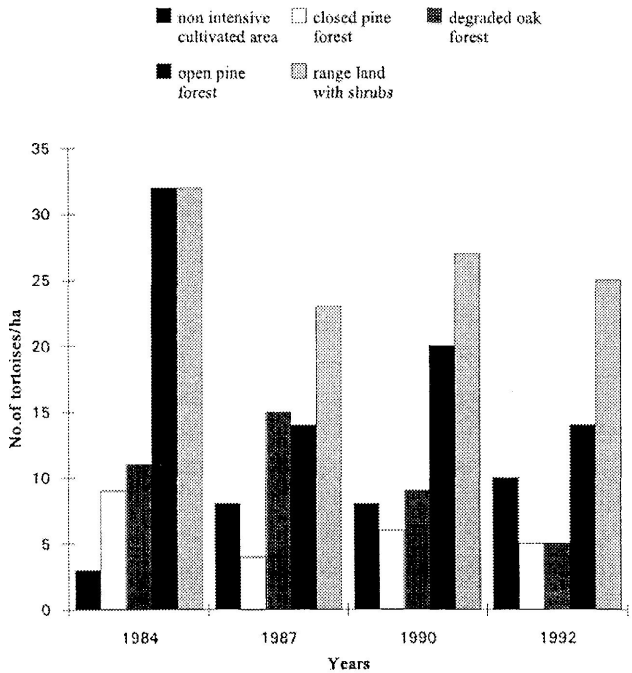


Figure 6. Length classes of tortoise carapaces on the Egyptian Vulture nests in Dadia forest.



food source of the Egyptian Vulture a special effort was made to estimate their availability. The study area has been classified into five different biotopes. Figure 7 shows these with their respective mean density of tortoises. The open pine and range lands with shrubs had the higher mean density of tortoises (20 and 27 tortoises/ha respectively), followed by degraded oak forest (10/

Figure 7. Density of tortoises in five diferent habitats.



ha), non-intensive cultivated areas (7/ha) and closed pine forest (6/ha).

DISCUSSION

The number of breeding pairs of Egyptian Vultures in Dadia forest has nevertheless declined rapidly during the last ten years. However, their breeding success was relatively high compared with data reported from different parts of the Mediterranean area (Ceballos & Donazar 1989; Ceballos & Donazar 1988; Levy 1990; Bergier & Cheylan 1980).

The attempt made to counter the shortage of carrion in the nesting area by setting up a vulture feeding station in 1987 had no essential effects on the Egyptian Vulture population, except for a small increase in the average percentage of survival of the young, especially in nests with two eggs. The supplementary food supply, however, had positive effects on the Cinereous Vulture population, which increased its breeding pairs in Dadia forest from four in 1984 to thirteen in 1992.

The decrease in hatchability of the Egyptian Vulture seems to be affected by other factors, such as predation, disturbance and competition. During this

study, four nests were deserted as a result of competition with Eagle Owl *Bubo bubo*, Lanner Falcon *Falco biarmicus* and Raven *Corvus corax*. The same observation has been reported by Levy (1990).

All nests were found in small cliffs scattered over the area. The data agree with Ceballos & Donazar (1989), that the species nests in a wide range of cliffs, preferring sites two-thirds of the way up them. The choice of nests at the bottom of the valleys is explained by the necessity of reducing energy investment in carrying food to the nest (McEwan & Hirt 1979).

The Egyptian Vulture is an unspecialized scavenging raptor (Houston 1975) which, apart from carcasses of large animals (wild herbivores and livestock), feeds on alternative food sources such as garbage dumps or preys on small animals (birds, tortoises, lizards, snakes). In the present study, young tortoises seem to be the most important live prey in the diet. Further research is needed to find out where and how the Egyptian Vulture can find these. When the feeding station was established the frequency of occurrence of tortoises, birds and snakes decreased in its diet, while an increase in the percentage of livestock was observed due to food supplied by humans. The reduction of the tortoises in the diet may not be affected by the feeding station but may be due to a decrease in the availability of tortoises in the area.

The data from the present study show that the number of breeding pairs of Egyptian Vulture has rapidly declined during the last ten years. Breeding success has not been affected by the feeding station and most of the nesting sites are still unoccupied (apart from some cases). This means that the decline of the Egyptian Vulture population is not affected by local factors (food, nesting sites) but seems to be related to the survival of the species in its wintering areas.

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